AEC-NASA TECH BRIEF

Pure Xenon Hexafluoride Prepared for Thermal Properties Studies

A preparative method, based on the formation of a complex salt of xenon hexafluoride and sodium fluoride, was developed to yield a sample of the highest possible purity for use in thermal measurements. The chief advantage of the method is that the desired hexafluoride can easily be freed from the common contaminants, xenon tetrafluoride, xenon difluoride, and xenon oxide tetrafluoride, because none of these compounds reacts with sodium fluoride. Measurements indicate that the concentration of liquid-soluble, solid-insoluble impurities in a sample obtained by this method is approximately 0.16 mole %.

Heat capacity measurements presently are being carried out on xenon hexafluoride covering the temperature range 4° to 350°K. There are two regions in which the heat capacity of solid xenon hexafluoride is anomalously high: one extending from approximately 241° to 261°K; the other from approximately 288° to 297°K. In these regions, the time required for equilibrium after heating is extremely long. This behavior could be due to two isothermal phase transitions; however, there is some evidence that the high heat capacity values around 293°K are associated with a structural change. A phase change would explain the difficulties which are experienced in attempting to grow single crystals of xenon hexafluoride at room temperature.

Other observations of the thermal behavior suggest that there may be three solid modifications of xenon hexafluoride: one which is stable between 293°K and the melting point; a second form which is stable between 251° and 293°K; and a third form which is stable below 251°K.

A preliminary value for the enthalpy change when the sample is heated from 232° to 270°K is 876 J/mole. The value for the range from 286° to 310°K is 1224 J/mole.

The enthalpy of fusion was found to be 5745 J/mole. The melting point of the present sample is 322.38°K, and the calculated melting point of pure xenon hexafluoride is 322.62 ± 0.20°K.

The report also includes laboratory techniques for preparing and calorimetrically measuring xenon hexafluoride, plus much more detail and explanation of the results.

Notes:

1. This material is of scientific interest and should be useful to researchers, educators, and others concerned with the noble gases.
2. Additional details are contained in *Inorg. Nucl. Chem. Letters*, vol. 1, p. 97–100, 1965.
3. Inquiries concerning this innovation may be directed to:

   Office of Industrial Cooperation
   Argonne National Laboratory
   9700 South Cass Avenue
   Argonne, Illinois 60439
   Reference: B67-10577

Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
Chicago Operations Office
9800 South Cass Avenue
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Category 03

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